DEVICE FOR RECORDING SPATIAL IMAGES IN MULTIPLE VIEWS

DESCRIPTION

[0001] The invention relates to a device for recording spatial images in multiple views, i.e. in a 3-D camera.

[0002] The related art is replete with known arrangements and methods for recording multiple views of a spatial scene or an object. The recording is usually made with a view to a subsequent representation. This means particularly that in a representation involving one stereo image pair, i.e. with a two-channel procedure, only two images must be recorded. However, if the subsequent representation is to be based on many, e.g. eight views, usually eight complete recordings must also be made. The particular difficulty thus arises of perfectly synchronising all the parameters of eight cameras such that the resulting images may be used immediately for an unlimited and correct spatial representation.

[0003] The object of the present invention is therefore to describe a device for recording spatial images in multiple views that may be operated with minimal effort and is also capable of recording as many views as possible.

[0004] This object is solved according to the invention by a device for recording spatial images in multiple views, including

- a stereo image camera (1) for simultaneous or temporally multiplexed recording of two views of an object or scene (2), i.e. a "stereo image pair",

- a computing unit (3) that is designed to calculate further views of the object or scene (2) on the basis

of the stereo image pair recorded by the stereo image camera, and

- means (4) for making all views A_k (k = 1...n), i.e. of the stereo image pair and the calculated further views, available for further use.

[0005] The stereo image camera (1) may incorporate for example two individual cameras that may be controlled simultaneously but separately by the computing unit (3).

[0006] However it is also conceivable that the stereo image camera (1) may include only one camera, this camera being capable of capturing temporally offset images from different viewing positions by using an optical lens.

[0007] Any other form of a known stereo image camera may also be used. The computing unit (3) is designed to calculate further views of the object or scene (2) on the basis of the stereo image pair recorded by the stereo image camera, and using photogrammetric procedures that are implemented via the hardware.

[0008] In order to achieve a total of for example 8, 24 or 40 views, preferably 6, 22 or 38 additional views must be calculated.

[0009] Photogrammetric procedures are known from the prior art and do not need to be explained further here.

[0010] Alternatively, the computing unit (3) may be designed to calculate further views of the object or scene (2) on the basis of the stereo image pair recorded by the stereo image camera using morphing procedures that are implemented via the hardware.

[0011] Morphing procedures are known from the prior art and do not need to be explained further here.

[0012] The term "hardware implementation" in the preceding explanations refers to a control program that is stored in computing unit (3) and controls computing unit (3) in such manner that the unit performs the corresponding procedural steps with the raw data provided.

[0013] In yet another embodiment, computing unit (3) may determine the disparity between two individual images of the stereo image pair from the stereo image pair recorded by the stereo image camera and calculate further views of the object or scene (2) on the basis of this disparity information. Methods for determining the disparity between corresponding individual images or for generating multiple views based on one view and the associated disparity information are known from the prior art and do not need to be explained further here.

[0014] Additional procedures implemented via the hardware for the purpose of generating further views directly or indirectly from a stereo image pair may be implemented via the hardware to control the computing unit and are included in the scope of the invention. These particularly include procedures that are also known in the prior art, which reconstruct a spatial scene on the basis of a stereo image pair and create the associated individual views therefrom for example by orthogonal projection.

[0015] In a special embodiment of the device according to the invention, besides the calculation steps described in the aforegoing, computing unit (3) calculates the depth information associated with one view of the stereo image pair from that stereo image pair view - e.g. the left view - on the basis of a conversion from two-dimensional images to two-dimensional images with depth information. From this

starting point, equivalent images for the additional views may also be calculated in turn. Computing unit (3) preferably compares the further views obtained by the calculation steps described above sequentially with the further views obtained from the stereo image pair view with the associated depth information. If discrepancies occur, the further views prepared by means (4) are corrected by reference to the further views with the associated depth information yielded by the stereo image pair view.

[0016] Otherwise, whether the calculated further views fall between the two views of a stereo image pair (equivalent to an interpolation) or outside the limits of the two views of a stereo image pair (equivalent to an extrapolation) in terms of their image content is not relevant for the purposes of the invention.

[0017] Means (4) preferably include a storage medium, on which all views are stored.

[0018] Of course, the device according to the invention is able to perform the calculations described in a cyclical sequence for multiple stereo image pairs, thereby creating a film in multiple views.

[0019] The invention will be described in greater detail with reference to an embodiment thereof.

[0020] In the drawing:

[0021] Figure 1 is a schematic diagram of the mode of operation of the device according to the invention.

[0022] An exemplary embodiment of the device according to the invention for recording spatial images in multiple views includes

- a stereo image camera (1) for simultaneous recording of two views of an object or scene (2), i.e. a "stereo image pair",

- a computing unit (3) that is designed to calculate further views of the object or scene (2) on the basis of the stereo image pair recorded by the stereo image camera, and

- means (4) for making all views A_k (k = 1...n), i.e. of the stereo image pair and the calculated further views, available for further use.

[0023] Stereo image camera (1) preferably incorporates two individual cameras that may be controlled simultaneously but separately by computing unit (3), as shown in Figure 1.

[0024] Alternatively, it is also conceivable that the stereo image camera (1) may include a single camera, wherein this camera captures temporally offset images from different viewing positions by using an optical lens. Such a system, named "Nu View" is offered by 3-D Video Inc. (USA).

[0025] Computing unit (3) is preferably designed to calculate further views of the object or scene (2) on the basis of the stereo image pair recorded by the stereo image camera using morphing procedures implemented by the hardware.

[0026] Morphing procedures are known from the prior art and do not need to be explained further here. The term "hardware implementation" in the preceding explanations refers to a control program that is stored in computing unit (3) and controls computing unit (3) in such manner that the unit performs the corresponding procedural steps with the raw data provided.

[0027] In an alternative embodiment, computing unit (3) may determine the disparity between the two individual images of the stereo image pair from the stereo image pair recorded by the stereo image camera and calculate further views of the object or scene (2) on the basis of this disparity information. Methods for determining the disparity between corresponding individual images or for generating multiple views based on one view and the associated disparity information are known from the prior art and do not need to be explained further here.

[0028] An example of an article that deals with this topic has been written by B. Porr, A. Cozzi, and F. Wörgötter and is entitled "How to "hear" visual disparities: real-time stereoscopic spatial depth analysis using temporal resonance".

[0029] In a special embodiment of the device according to the invention, besides the calculation steps described in the aforegoing, computing unit (3) calculates the depth information associated with one view of the stereo image pair from that stereo image pair view - e.g. the left view - on the basis of a conversion from two-dimensional images to two-dimensional images with depth information; equivalent procedures are described for example in WO 972400 and WO 9930280. From this starting point, equivalent images for the additional views may also be calculated in turn. Computing unit (3) preferably compares the further views obtained by the calculation steps described above sequentially with the further views obtained from the stereo image pair view with the associated depth information. If discrepancies occur, the further views prepared by means (4) are corrected by reference to the further views with the associated depth information yielded by the stereo image pair view.

[0030] Otherwise, whether the calculated further views fall between the two views of a stereo image pair (equivalent to an interpolation) or outside the limits of the two views of a stereo image pair (equivalent to an extrapolation) in terms of their image content is not relevant for the purposes of the invention.

[0031] Means (4) preferably include a storage medium, on which all views are stored for subsequent use.

[0032] Of course, the device according to the invention is able to perform the calculations described in a cyclical sequence for multiple stereo image pairs, thereby creating a film in multiple views.

[0033] The device according to the invention provides an inexpensive means for capturing multiple views of an object or scene that may be constructed using known components.

[0034] Depending on the configuration of the computing unit, even real-time recordings may be created in many, e.g. eight, views.

KEY TO LEGEND

1. Stereo image camera
2. Object or scene to be captured
3. Computing unit
4. Means for providing views

ABSTRACT

The invention concerns a device for recording spatial images in multiple views, i.e. in a 3-D camera, including a stereo image camera (1) for simultaneous or temporally multiplexed recording of two views of an object or scene (2), i.e. a "stereo image pair", a computing unit (3), which is designed to calculate further views of the object or scene (2) on the basis of the stereo image pair recorded by the stereo image camera, and means (4) for making all views A_k (k = 1...n), i.e. of the stereo image pair and the calculated further views, available for further use. The device can be realised inexpensively using existing components and can be used to create entire films in several views at once.